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AUTOMATIC MEDIA ALIGNMENT NIP RELEASE MECHANISM

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AUTOMATIC MEDIA ALIGNMENT NIP RELEASE MECHANISM

BACKGROUND

[001] The present invention relates generally to the field of image formation and in particular to an automatic media alignment nip release mechanism.

[002] Media sheets in image formation devices are preferably aligned to eliminate skew. That is, the leading edge of the media sheet is aligned to be parallel to the axes of the photoconductive members used to transfer developed images to the media sheet. A media sheet is aligned if, when crossing a line across the media path perpendicular to direction of travel, the leading edge of the media sheet encounters the line at the same time along its extent. A media sheet is skewed if, for example, when crossing such a line, one of the leading corners of the media sheet encounters the line before the other leading corner.

[003] One method of media sheet alignment known in the art is referred to herein as "bump alignment." A media sheet is directed to the nip formed between two rollers, the surfaces of which are in contact along their length. The media sheet is briefly driven after the leading edge has contacted the nip of rollers, causing a "bump" or curvature, to form in the media sheet. This deformation of the media sheet exerts a forward force on the leading edge of the sheet, forcing it against the nip of the rollers. The malleability of the deformation allows either leading corner to advance slightly, relative to and independently of the other leading corner, until the leading edge is flush with the nip along its entire length, thus eliminating any skew in the positioning of the leading edge relative to the axes of the two rollers. At least one of the rollers is then driven, capturing the leading edge of the media sheet simultaneously along the nip, and passing the media sheet along in an aligned orientation.

[004] In some cases, a registration function may be combined with the media sheet alignment function. Registration refers to the timing of advancing a media sheet into the image formation path. Advancing a media sheet from a known position (the nip of the alignment/registration rollers) at a specific time provides a precise temporal demarcation against which downstream image formation processes may be referenced, to ensure high quality image formation (such as, for example, ensuring accurate registration of plural color planes transferred at plural image formation stations).

[005] To function properly, the alignment nip must be formed with a relatively high nip force. This presents a difficulty in clearing jams, as the alignment rollers grip the media sheet tightly. Additionally, in image forming devices wherein parts of the media sheet travel path separate, such as when a door or other subunit on which some elements are mounted is opened or otherwise moved away from the main housing, damage may result if a media sheet spans the separation point, and is being tightly held in the alignment nip.

SUMMARY

[006] The present invention relates to an image forming apparatus having an apparatus housing and a subunit moveable between open and closed positions with respect to said apparatus housing. The image forming apparatus includes a drive roller and backup roller disposed adjacent and parallel in the apparatus housing, a transport roller mounted in a frame and operative to guide a media transport belt, and a mechanical linkage connected to the backup roller and operative to engage and disengage the transport roller frame. The mechanical linkage is also operative to move the backup roller between an engaged position wherein the backup roller contacts the drive roller to form a nip therebetween, and a retracted position wherein the backup roller does not contact the drive roller, in response to the mechanical linkage

disengaging the transport roller frame.

[007] In another aspect, the present invention relates to a media alignment mechanism for an image forming apparatus having a subunit moveable between open and closed positions. The mechanism includes a housing having a continuous bearing, a segmented bearing and a cam follower surface. A drive roller is disposed in the continuous bearing. A backup roller having a shaft is disposed in the segmented bearing, adjacent and parallel to the drive roller, and moveable between an engaged position wherein the backup roller contacts the drive roller to form a nip therebetween, and a retracted position wherein the backup roller does not contact the roller, in response to the subunit moving from a closed to an open position. The mechanism also includes a biasing member operative to bias the backup roller to the engaged position.

[008] In yet another aspect, the present invention relates to a method of releasing a media sheet from nip between two rollers disposed in an image formation apparatus having a subunit movable between closed and open positions. The method includes engaging and disengaging an element mounted on the subunit with a mechanical linkage disposed in the housing as the subunit is moved between closed and open positions. The method further includes, in response to engaging or disengaging the element, moving one of the rollers between an engaged position in which it forms a nip with the other roller and a retracted position in which it is spaced apart from the other roller, thereby releasing the media sheet from the nip when the one roller is in the retracted position.

BRIEF DESCRIPTION OF DRAWINGS

[009] Figure 1 is a schematic diagram of a representative image forming apparatus having alignment rollers.

[0010] Figure 2 is a schematic diagram of a representative image forming apparatus

having a subunit movable between open and closed positions.

[0011] Figure 3 is a schematic view of a media alignment mechanism wherein a backup roller is in an engaged position.

[0012] Figure 4 is a schematic view of a media alignment mechanism wherein a backup roller is in a retracted position.

[0013] Figure 5 is a perspective view of a media alignment housing.

DETAILED DESCRIPTION

[0014] The disclosure of copending patent application _____, filed concurrently herewith and assigned to the assignee of the instant application, is hereby incorporated by reference in its entirety.

[0015] Figure 1 depicts a representative image forming apparatus, indicated generally by the numeral 10. The image forming apparatus 10 comprises a housing 12 with a top portion 11, subunit 13 movable between open and closed positions with respect to the housing 12 and a media tray 14. The media tray 14 includes a main media sheet stack 16 with a sheet pick mechanism 18, and a multipurpose tray 20 for feeding envelopes, transparencies and the like. The media tray 14 is preferably removable for refilling, and located on a lower section of the device 10.

[0016] Within the image forming apparatus body 12 and/or in the subunit 13, the image forming apparatus 10 includes media registration mechanism 22 comprising driver roller 102 and backup roller 104, a media sheet transfer belt 24 with transfer belt roller 25, one or more removable developer units 26, a corresponding number of removable photoconductor units 28, an imaging device 30, a fuser 32, reversible exit rollers 34, and a duplex media sheet path 36, as well as various rollers, actuators, sensors, optics, and electronics (not shown) as are conventionally known in the image forming apparatus arts, and which are not further explicated herein.

[0017] Each developer unit 26 mates with a corresponding photoconductor unit 28, with the developer unit 26 developing a latent image on the surface of a photoconductive member in the photoconductor unit 28 by supplying toner. In a typical color printer, three or four colors of toner – cyan, yellow, magenta, and optionally black – are applied successively (and not necessarily in that order) to a print media sheet to create a color image. Correspondingly, Figure 1 depicts four pairs of developer units 26 and photoconductor units 28.

[0018] The operation of the image forming apparatus 10 is conventionally known. Upon command from control electronics, a single media sheet is "picked," or selected, from either the primary media stack 16 or the multipurpose tray 20. Alternatively, a media sheet may travel through the duplex path 36 for a two-sided print operation. Regardless of its source, the media sheet is presented at the nip of a media alignment mechanism 22, which aligns the media sheet and precisely times its passage on to the image forming stations downstream. The media alignment mechanism 22 may also be referred to in the art as one or more registration rollers.

[0019] After media sheet passes the media alignment mechanism 22 it contacts the transport belt 24, which carries the media sheet successively past the photoconductor units 28. At each photoconductor unit 28, a latent image is formed by the imaging device 30 and optically projected onto a photoconductive member. The latent image is developed by applying toner to the photoconductive member from the corresponding developer unit 26. The toner is subsequently deposited on the media sheet as it is conveyed past the photoconductor unit 28 by the transport belt 24.

[0020] The toner is thermally fused to the media sheet by the fuser 32, and the sheet then passes through reversible exit rollers 34, to land facedown in the output stack 35 formed on the exterior of the image forming apparatus body 12. Alternatively, the exit rollers 34 may reverse motion after the trailing edge of the media sheet has passed the

entrance to the duplex path 36, directing the media sheet through the duplex path 36 for the printing of another image on the back side thereof.

[0021] Figure 2 depicts the image forming apparatus 10 with the subunit 13 in an open position, in which it is separated from the main housing 12 by pivoting about a hinge point 15. At least the media sheet transport belt 24, a transport roller 25 and the photoconductor units 28 are mounted to the subunit 13.

[0022] Figure 3 depicts the media alignment mechanism 22 when the subunit 13 is in a closed position, placing the media transport belt 24 above the media alignment mechanism 22. Figure 3 also depicts a media sheet 15 passing through the media alignment mechanism 22 and contacting the transport belt 24. The media alignment mechanism 22 comprises a media alignment housing 100 (see Figure 5), drive roller 102, backup roller 104 and biasing member 110. The drive roller 102 and backup roller 104 are disposed in the media alignment housing 100, in drive roller bearing 103 and backup roller bearing 105, respectively.

[0023] As shown in Figure 5, unlike the drive roller bearing 103, the backup roller bearing 105 does not extend in a continuous manner around the full circumference. Rather, the backup roller bearing 105 comprises a front segment 114 formed in the main media alignment housing 100 and a rear segment 116 attached to a flexible roller holder 112 extending from the media alignment housing 100. Such a bearing is referred to herein as a "segmented bearing." The rear segment 116 is operative to move, via slight deformation of the flexible roller holder 112, from a position abutting the front segment 114 to a position spaced apart from the front segment 114. The flexible roller holder 112 may additionally include a biasing member locator 118 disposed opposite the rear backup roller bearing segment 116. The biasing member 110 is positioned over the biasing member locator 118 at one end, with the other end positioned against the image forming apparatus housing 12 or some rigid body affixed thereto.

[0024] As Figure 3 depicts, the media alignment mechanism 22 is mechanically linked to the transport belt 24 and transport roller 25 disposed on the subunit 13 by a link member 106 and bell crank 108. This mechanical linkage, described in detail below, is operative to move the backup roller 104 between an engaged position when the subunit 13 is closed and a retracted position when the subunit 13 is open. In the engaged position, the backup roller 104 presses against the drive roller 102 to form a media alignment nip therebetween. The roller 104 is biased to the engaged position by the biasing member 110, which may comprise for example a spring in compression. The biasing member 110 additionally provides a nip force between the backup roller 104 and the drive roller 102. In a retracted position, the backup roller does not contact the drive roller 102.

[0025] The backup roller 104 is moved between the engaged and retracted positions by actuation of a cam surface 107 on the link member 106 with a cam follower surface 101 formed on the media alignment housing 100. As shown in Figure 3, the cam surface 107 does not engage with the cam follower surface 101 when the subunit 13 is closed.

[0026] As the subunit 13 moves from an open to a closed position, the bell crank 108, disposed in the image forming apparatus housing 12, engages the frame holding the transport roller 25, disposed on the subunit 13, and precisely locates the transport roller 25 within the assembly housing 12 (alternatively, the bell crank 108 may engage the transport roller 25 directly). This positions the transport belt 24 over the media alignment mechanism 22, as shown in Figure 3. Note that the media sheet 15 is both engaged in the media alignment mechanism 22 and in contact with the transport belt 24.

[0027] Because the bump alignment function of the media alignment mechanism 22 requires a relatively high nip force between the drive roller 102 and backup roller 104, jammed media sheets 15 are difficult to remove from the media alignment mechanism

22. In addition, if the subunit 13 were opened with a media sheet 15 advanced past the first image forming station, the media sheet 15 may be electrostatically adhered to the transport 24, or alternatively may be held by a force between the photoconductive member 29 and a transfer roller opposite transport belt 24 from the photoconductive member 29. In either case, as the transport belt 24 (mounted on the subunit 13) moves away from the apparatus housing 12, if the media sheet is fixed in the media alignment mechanism 22, it may slip on the transport belt 24. This has the potential to damage one of the photoconductive members in a photoconductor unit 28, or to dislodge a photoconductor unit 28 from its mounting position on the subunit 13. According to the present invention, such damage or dislodging is avoided by automatically moving the backup roller 104 of the media alignment mechanism 22 to a retracted position, releasing the nip force between it and the drive roller 102, releasing the media sheet and allowing it to be carried on the transport belt 24, for easy removal by an operator.

[0028] As the subunit 13 opens and the transport roller 25 moves away from the media alignment mechanism 22, the bell crank 108 rotates in a clockwise direction about point 109, as depicted in Figure 4. The bell crank 108 is mechanically linked to the link member 106, and causes the link member 106 to pivot the about the axis of the backup roller 104 in a counterclockwise direction as depicted in Figure 4. This actuates the cam surface 107 on the link member 106 against the cam follower surface 101 on the media alignment housing 100, forcing the backup roller 104 to translate laterally away from the drive roller 102, to the right as depicted in Figure 4, to a retracted position. In this position, the media sheet 15 may be easily removed from the media alignment mechanism 22. Additionally, if the media sheet 15 is in contact with the transport belt 24, it may freely exit the media alignment mechanism 22 as the subunit 13 is opened, avoiding damage to components mounted adjacent the transport belt 24.

[0029] The backup roller 104 translates laterally away from the drive roller 102 via the

separation of the backup roller bearing 105 into a separate front segment 114 and rear segment 116, as depicted in Figure 5. The rear segment 116 is affixed to the flexible roller holder 112, which permits of the slight distortion necessary to translate the backup roller 104. Preferably, in the fully retracted position, the backup roller 104 is spaced apart from the drive roller 102 by about 1 mm. However, in other embodiments, the backup roller 104 may be spaced a greater or lesser distance. In some embodiments, the retracted position may merely counter the nip force, leaving the drive roller 102 and backup roller 104 in nip contact.

[0030] When the subunit 13 is again closed, the bell crank 108 engages a frame holding the transport roller 25, rotating counterclockwise about point 109. This pivots the link member 106 about the axis of the backup roller 104 (clockwise as depicted in Figures 3 and 4), disengaging the cam surface 107 from the cam follower surface 101. Referring to Figure 5, the biasing member locator 118 on the flexible roller holder 112, is opposite the rear segment 116 of the backup roller bearing 105. When the biasing member 110 (see Figure 3) is positioned between the biasing member locator 118 and a rigid element of the housing 12 of the image formation apparatus 10, it urges the rear segment 116 of the backup roller bearing 105 against the backup roller 104, translating the backup roller 104 to the left as viewed in Figures 2-5, to an engaged position against the drive roller 102, forming a nip therebetween. The biasing member 110 continues to urge the backup roller 104 against the drive roller 102, generating the nip force necessary for the bump alignment function of the media alignment mechanism 22.

[0031] The present invention has been described herein with respect to an embodiment of the image forming apparatus in which developer units 26 are disposed within the housing 12 and photoconductor units 28 are disposed on an openable subunit. The present invention is not limited to this embodiment. For example, the image formation apparatus 10 may include integrated removable cartridges, each including

toner, a developer roller and a photoconductive member. These cartridges may be mounted in the housing 10, with only the transport belt 24 and transport roller 25 disposed on the openable subunit. Those of skill in the art will be readily recognize other possible configurations within the scope of the present invention.

[0032] Although the present invention has been described herein with respect to particular features, aspects and embodiments thereof, it will be apparent that numerous variations, modifications, and other embodiments are possible within the broad scope of the present invention, and accordingly, all variations, modifications and embodiments are to be regarded as being within the scope of the invention. The present embodiments are therefore to be construed in all aspects as illustrative and not restrictive and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.